R09

Code No: 09A30401

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY, HYDERABAD

B.Tech II Year I Semester Examinations, November/December-2013

Probability Theory and Stochastic Processes

(Common to ECE, ETM)

Time: 3 hours **Max. Marks: 75**

Answer any five questions
All questions carry equal marks

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1.a) State and prove the theorem of total probability.

b) Two boxes $B1$ and $B2$ contain 100 and 200 light bulbs respectively. $B1$ and $B2$ have 15 and 5 defective bulbs respectively.
i) Suppose a box is selected at random and one bulb is picked out. What is the probability that it is defective?
ii) Suppose we test the bulb and it is found to be defective. What is the probability, that it came from $B1$? [15]

2.a) Check whether the following function is a valid distribution function $G_X(x) = 3[u(x\text{-a}) - u(x\text{-}3\text{a})]$. Mention the properties used for justification.

b) Given k is a constant and X is a random variable with

$$f_X(x) = \begin{cases} kx & 0 < x < 1 \\ 0 & \text{otherwise} \end{cases}$$

Determine the value of k and also find $P(1/4 < x \leq 1/2)$.

c) Represent the expression and sketch of pdf of Gaussian random variable. Also explain the significance of Gaussian random variable. [15]

3.a) Find the mean of Poisson random variable.

b) If X and Y are random variables related by the transformation Y = A tanX, where A is a positive constant, where X is uniformly distributed in the interval $(-\pi/2, \pi/2)$. Express $f_Y(y)$ in terms of $f_X(x)$. [15]

4.a) If X and Y are independent random variables and W = X+Y, obtain the probability density function of W interms of pdf of X and pdf of Y.

b) Write all the properties of joint density function and obtain marginal densities of $f_{XY}(x, y) = u(x)u(y)x\, e^{-(y+1)}$. [15]

5.a) For the transformations $Y_1 = aX_1 + bX_2$, $Y_2 = cX_1 + dX_2$ where a, b, c, d are real constants and X_1, X_2, Y_1, Y_2 are random variables. Derive the expression for joint density of Y_1, Y_2 in terms of joint density of X_1, X_2.

b) Two random variables X and Y have the joint characteristic function $\Phi_{XY}(\omega_1, \omega_2) = \exp(-2\omega_1^2 - 8\omega_2^2)$ find E[X], E[Y] and R_{XY}. [15]

6.a) Check whether the random process $X(t) = A\cos(\omega_o t + \Theta)$ is WSS process or not, for 'A' and ω_0 being constant and Θ uniformly distributed between $(0, 2\pi)$.

b) Write the properties of autocorrelation function of a random process and prove any two of them. [15]

7.a) State and prove Wiener – Khintchine relations.

b) Find the power density spectrum of a random process whose autocorrelation function is $R_{XX}(\tau) = A \cos(\omega_o \tau)$. [15]

8.a) Derive the expression for overall noise figure of a cascaded two port network.

b) Write notes on white noise.

c) Explain the concept of effective input noise temperature. [15]

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